

NON-PUBLIC?: N
ACCESSION #: 9010220256
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Duane Arnold Energy Center PAGE: 1 OF 04

DOCKET NUMBER: 05000331

TITLE: Manual Scram Following Loss of Air System Pressure Due to Poorly Soldered Joint

EVENT DATE: 09/13/90 LER #: 90-015-00 REPORT DATE: 10/12/90

OTHER FACILITIES INVOLVED: None DOCKET NO: 05000

OPERATING MODE: N POWER LEVEL: 037

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:

50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

NAME: James R. Probst - Technical Support TELEPHONE: (319) 851-7308
Engineer

COMPONENT FAILURE DESCRIPTION:

CAUSE: B SYSTEM: LF COMPONENT: TBG MANUFACTURER:
REPORTABLE NPRDS: N

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT:

On September 13, 1990, with the reactor at approximately 37% power, Operations personnel manually scrambled the reactor (Reactor Protection System initiation) when rapidly decreasing Instrument Air pressure resulted in reactor vessel level control difficulties. The feedwater regulating valves, which receive their motive power from Instrument Air, "locked up" in their current position, resulting in a gradual increasing trend in reactor vessel level. Primary Containment Isolation System Groups Two through Five initiated as designed on reduced level following the scram. The plant was returned to a stable condition with no further problems. The cause of the Instrument Air pressure loss was the failure of a three-inch soldered copper fitting joint at an air dryer inlet. Examination of the joint found inadequate solder coverage. Larger joints are difficult to solder, and code-required visual examination and in-

service testing may not detect reduced solder coverage. As corrective actions, all other air system joints soldered in the same time period were inspected and repaired as necessary, and a sampling inspection of other soldered joints is ongoing. Inspection criteria for certain difficult joints is being modified to include ultrasonic testing.

END OF ABSTRACT

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I. DESCRIPTION OF EVENT:

On September 13, 1990, at approximately 1911 hours, with the reactor operating at approximately 37% power, rapidly decreasing Instrument Air header pressure was noted by Operations personnel in the Control Room. Per design, the reactor feedwater regulating valves "locked up" at their current position due to the decreasing air pressure. Instrument Air provides their motive force in normal operation. Operations personnel attempted to manually control feedwater flow and vessel level using motor-operated valves, but reactor water level slowly increased. At 1913 hours, the reactor was manually scrammed (Reactor Protection System initiation) due to the increasing level, which was then at 207 inches above top of active fuel (TAF), versus the normal level of 192 inches. As expected following the manual scram, reactor water level decreased to 158 inches TAF due to void reduction. Primary Containment Isolation System Groups 2, 3, 4 and 9 isolated as designed due to low reactor vessel level. Reactor water level was restored with feedwater flow, and the plant restored to a stable condition with no further problems.

At the time the decreasing air header pressure was noted, an Operator was dispatched to the central area for Instrument Air piping. It was determined that a copper fitting joint on the three inch air inlet line of the "B" instrument air dryer had failed, resulting in separation of the line. Within a few minutes the leak was isolated and bypassed, and the Instrument Air header repressurized with the redundant air dryer in service.

II. CAUSE OF EVENT

The cause of the loss of Instrument Air header pressure was determined to be the failure of a soldered copper fitting joint on the three inch inlet line of the "B" air dryer. This line was added in 1989 when a second air dryer was installed. The fitting joint which failed was at the top of an eight foot vertical run of the copper tubing, at a ninety degree fitting that brought the pipe to a horizontal position.

Examination of the joint revealed inadequate solder coverage at the lap portions of the joint. Most of the solder was centered around the bottom of the joint. Interviews and a review of the records surrounding the joint's construction indicate the final soldering was done by an experienced individual after joint preparation by others. There do not appear to have been negative human factors considerations such as severe time constraints. Post-construction testing of the joint consisted of a visual examination followed by an in-service leakage test of the air system. These examinations indicated the joint was acceptable.

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The principle contributor to the joint failure was the inadequate solder coverage. Soldering of joints on larger tubing, such as this air inlet, is a difficult procedure. A poorly-soldered joint may not be visually apparent, as the fitting covers the solder. Subsequent examination of the other solder joints installed in the air system in 1989 via ultrasonic testing (UT) found a number of other insufficient connections, primarily within larger diameter tubing similar to the line which failed. A second factor in the joint failure was post-construction testing methodology that, although performed in accordance with code requirements, in retrospect was inadequate to determine the acceptability of the joint.

III. ANALYSIS OF EVENT

The Instrument Air System consists of three primary compressors, and three backup compressors. One compressor is normally running to supply system demand. There are two air dryers, one of which is normally in service. Loss of Instrument Air does not preclude the proper operation of safety-related equipment. Air-powered containment isolation valves and dampers fail in a fail-safe position, are supplied with air accumulators or backup stored compressed air, or are fed from other, safety-related air compressors which serve as a reliable air supply in the event of air system loss. Loss of Instrument Air may require plant shutdown due to removal of the automatic level control feature of the feedwater system, but no systems required to reach and maintain a stable shutdown condition are affected.

IV. CORRECTIVE ACTIONS

The failed joint has been repaired and verified acceptable by UT examination. The other air system tubing joints soldered in 1989 were also inspected by UT examination, and some were repaired. A sampling inspection program of other soldered joints in the plant is underway.

Plant procedures are being upgraded based on the lessons learned from this event. UT examinations will be required for certain soldered joints which are known to be difficult to perform, such as those on larger-diameter tubing or those in difficult positions. This will help ensure adequate joint installation. This method of examination is not a code-required practice but has proven very effective in determining the coverage of the solder and the extent of voids in the lap portions of the joint. This procedural enhancement will be completed by December 30, 1990.

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V. ADDITIONAL INFORMATION

A. Failed Component Identification

The failure occurred on three inch Type K copper tubing, at a three inch wrought copper ASTM B-62 solder joint, ninety degree elbow, with 50-50 Sn-Pb solder used.

B. Previous Similar Events

A manual scram following loss of Instrument Air due to valve mis-positioning occurred in April, 1990 (LER 90-02). LER 86-17 discusses a manual scram due to dessicant in the Instrument Air system blocking air pathways in a feedwater regulating valve controller.

C. EHS System / Component Codes

The following were noted in this LER:

System EHS System Code EHS Component Code

Instrument Air System LF TBG

Feedwater System
- Regulating Valve SJ FCV

Reactor Protection System JD

Primary Containment
Isolation System JM

This event is being reported in accordance with 10 CFR 50.73 (a)(2)(iv).

ATTACHMENT 1 TO 9010220256 PAGE 1 OF 1

Iowa Electric Light and Power Company

October 12, 1990
DAEC-90-0865

Mr. A. Bert Davis
Regional Administrator
Region III
U. S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, IL 60137

Subject: Duane Arnold Energy Center
Docket No: 50-331
Op. License DPR-49
Licensee Event Report #90-015

Gentlemen:

In accordance with 10 CFR 50.73 please find attached a copy of the
subject Licensee Event Report.

Very truly yours,

Rick L. Hannen
Plant Superintendent - Nuclear

RLH/JRP/sjo

cc: Director of Nuclear Reactor Regulation
Document Control Desk
U. S. Nuclear Regulatory Commission
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File A-118a

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